Citation:

Oba S, Shimizu N, Nagata C, Shimizu H, Kametani M, Takeyama N, Ohnuma T, Matsushita S. The relationship between the consumption of meat, fat and coffee and the risk of colon cancer: A prospective study in Japan. *Cancer Lett.* 2006; 244 (2): 260-267.

PubMed ID: 16519996

Study Design:

Prospective cohort study

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

- To determine the relationship between a western diet characterized by high fat intake and meat consumption and the risk of the development of colon cancer
- The relationship between coffee drinking and risk of colon cancer was determined.

Inclusion Criteria:

- Subjects who were in an original cohort of 36,990 men and women
- 35 years old or older
- Resided in Takayama, Japan
- Responded to a baseline self-administered questionnaire.

Exclusion Criteria:

- Subjects (N=595, 1.7%) who completed 45% or less of the questionnaire
- Subjects (N=1871, 5.5%) who provided unreliable or inconsistent responses
- The following were excluded from the analysis:
    - Persons with rectal cancer due to too few
    - Persons who died (nine men and 10 women) of colon cancer since they did not obtain information concerning the day of diagnoses
    - Three men and five women due to a discrepancy in the demographic information between the cohort and hospital data
    - 173 men and 532 women who had a history of cancer other than nonmelanoma skin cancer and 280 men and 207 women who had a history of colorectal adenoma.

Description of Study Protocol:

Recruitment

In September 1992 the author's established a study cohort with 36,990 men and women who were 35 years old or older and resided in Takayama, Japan.

Design

Prospective cohort study.

Dietary Intake/Dietary Assessment Methodology

Semi-quantitative food frequency questions:

- Collected information on the average frequency of consumption and serving size for 169 food items and dishes
- The food frequency questionnaire (FFQ) was previously validated in comparison with one three-day diet record, four 24-hour diet recalls, and 12 daily diet records over a year. The Spearman correlation coefficients between the FFQ and the daily records in men and women were 0.54 and 0.21 for red meat intake, 0.58 and 0.69 for processed meat intake and 0.72 and 0.57 for coffee intake, respectively
- From the collected data, the nutrient intake was estimated by r*eferring to the Standard Tables of Food Composition in Japan*, 5th edition, published by the Science and Technology Agency of Japan
- Definitions:
    - Red meat=beef and pork
    - Processed meat= Ham, sausage, bacon and *yakibuta* (Chinese style roasted pork)
- Fatty acid content in food was determined on the basis of data from a study by Sasaki et al.
- The total intake of long n-3 fatty acids was obtained from a summation of the eicosapentaenoic acid intake and docosahexaenoic acid intake
- Consumption of non-alcoholic beverages (coffee and green tea) was obtained with answers of nine frequency categories (never/less than a month, once a month, twice or three times a month, once a week, twice or three times a week, four-to-six times a week, once a day, twice or three times a day, more than four times a day)
- Alcohol consumption was estimated by inquiring about six different beverages: Sake, beer, light beer, shochu (domestic distilled spirits made from sweet potatoes, rice or buckwheat), wine and hard liquor (whisky, brandy, vodka, gin, rum and cocktails)
- For each beverage, the question was asked with nine frequency categories similar to those used for non-alcoholic beverages. For alcohol, questions concerning the amount consumed in cups, glasses or bottles on each occasion were asked
- From the collected data, the total ethanol intake was calculated in grams using the *Standard Tables of Food Composition in Japan*, 5th edition.

Blinding Used

Not applicable.

Intervention

Not applicable.

Statistical Analysis

- The association between nutrients or foods consumed and the risk of colon cancer was determined with a Cox-proportional hazard model and relative risks (RRs) and 95% CIs

were generated
- The length of the follow-up period was determined in person-years
- Nutrient and food intake: Nutrient and food consumption data were logarithmically transformed and adjusted for the total energy consumed using a method developed by Willett. The subjects were categorized into tertile groups according to the distribution of each nutrient or food consumed by all subjects. Tests for a linear trend or trend analyses, were performed on continuous variables with the use of median values of the categories
- Consumption of non-alcohol beverages was categorized into three groups. Trend analyses were conducted for the intake of non-alcohol beverages using the median values of the category. The amount of ethanol intake was used for the adjustment in the form of a continuous variable
- A multivariate adjustment was made for age, height, BMI and alcohol consumption
- Total pack-years of cigarette smoking and the amount of regular physical activity were considered
- For the analyses of non-alcohol beverages, the consumption of black tea was included, and the terms for green tea and coffee were mutually added to the model to adjust for the effects
- All the P-values presented in this study were two-sided, and the level of significance was 0.05. All the statistical analyses were performed using SAS programs (SAS Institute, Cary, NC, USA).

Data Collection Summary:

Timing of Measurements

Study subjects were followed from January 1, 1993, to December 31, 2000.

Dependent Variables

- Red meat, processed meat intake, long n-3 fatty acids, alcoholic beverage, non-alcoholic beverages
- Current and past smoking status, total years of smoking, and number of cigarettes smoked each day
- Average hours spent and estimated metabolic equivalents (METs) for regular physical activity both at work and in leisure for the following activities: Vigorous sports (such as jogging, bicycling on hills, tennis, racquet ball, swimming laps or aerobics), vigorous work requiring muscle strength and endurance (such as moving heavy furniture, loading or unloading trucks, shoveling or other equivalent manual labor), and moderate sports or work (such as housework, brisk walking, golfing, bowling, bicycling on level ground or gardening).

Independent Variables

Diagnosis of colon cancer.

Control Variables

A multivariate adjustment was made for:

- Age
- Height
- BMI
- Alcohol consumption

- Total pack-years of cigarette smoking
- Amount of regular physical activity.

Description of Actual Data Sample:

- *Initial N:* 36,990
- *Attrition (final N):* 30,221 subjects
  - 13,894 men
  - 16,327 women
- *Age:* 35 to 70 years
- *Ethnicity:* Japanese
- *Other relevant demographics:*
- *Anthropometrics:* Mean BMI 22.5 (2.8) and 22.0 (2.93) kg/m^2 for men and women, respectively
- *Location:* Takayama, Japan.

Summary of Results:

- From January 1, 1993 to December 31, 2000, 111 male and 102 female subjects were diagnosed with colon cancer
- The total energy, total fat intake, saturated fat, monounsaturated fat, long n-3 fatty acids and red meat intake were unrelated to the risk of colon cancer in men and women
- Polyunsaturated fat was positively associated with the risk of colon cancer in men, but the association did not achieve a statistical significance (RR in the highest tertile vs. the lowest tertile=1.65, 95% CI: 1.00-2.74, P=0.06)
- Total protein intake (RR in the highest tertile vs. the lowest tertile=1.54, 95% CI: 0.92-2.57, P for trend=0.11) and total meat intake (RR in the highest tertile vs. the lowest tertile=1.56, 95% CI: 0.98-2.49, P=0.07) had a non-significant positive association with the risk of colon cancer in men but no association in women
- Processed meat intake was significantly positively associated with the risk of colon cancer in men (RR in the highest tertile vs. the lowest tertile=1.98, 95% CI: 1.24-3.16, P<0.01).

Other Findings

- Since the latent symptoms of pre-diagnosed colon cancer could have influenced the dietary habits, excluded 33 men and 35 women who were diagnosed during the first three years of follow-up
- The results were substantially unchanged; the intake of processed meat increased the risk of colon cancer (RR in the highest tertile vs. the lowest tertile=2.26, 95% CI: 1.26-4.04, P for trend <0.01) among men, and daily coffee consumption decreased the risk of colon cancer (RR=0.42, 95% CI: 0.18-0.99, P for trend=0.05) among women.

Author Conclusion:

- The results of this study identified the association between food items regularly consumed and the risk of colon cancer in the study participants
- The high consumption of processed meat among men was positively associated, and the

existing habit of daily coffee intake among women was inversely associated with the risk of developing colon cancer
- The findings suggest a possible linkage between the components of a western diet or lifestyle and the risk of colon cancer among the general population in Japan.

Reviewer Comments:

The authors noted the following strengths of their study:

- *The information concerning the intake of food, beverages and nutrients was collected ahead of the diagnosis of colon cancer. Hence, the recall bias of the exposure is supposed to be minimal*
- *The study cohort consisted of a community-based population and the participation rate was high*
- *The food and nutrient information was collected through a validated semi-quantitative FFQ. The questionnaire also collected information for participant demographic information, physical exercise, smoking status, alcohol intake, medical history, reproductive events and physical exercise.*

The authors noted the following limitations of their study:

- *Relatively small number of cases of colon cancer. The inconsistency of the results obtained between men and women could be explained by the low incidence of colon cancer in the cohort*
- *Some individuals with colon cancer may have been misclassified and included among the control subjects. They consider the number of participants in the study to be sufficient to compensate for any such misclassification*
- *According to the death certificate notification percent (DCN%), an indicator of incidence of colon cancer incidence, the incidence of colon cancer may have been underreported in this cohort and thus some individuals with colon cancer could have been included to the control subjects*
- *The data for food and nutrient intake may have been overestimated by the questionnaire. In the validity study, the estimate of the total energy intake from the questionnaire was about 11% higher than that from the diet records. The questionnaire used in this study was designed to measure the relative intake of food and nutrients rather than their absolute values.*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes

3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

Validity Questions

1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	No
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A

3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	???
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	???
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	Yes
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	???
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	No
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	Yes
6.6.	Were extra or unplanned treatments described?	Yes

6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	???
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	No
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes

10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes